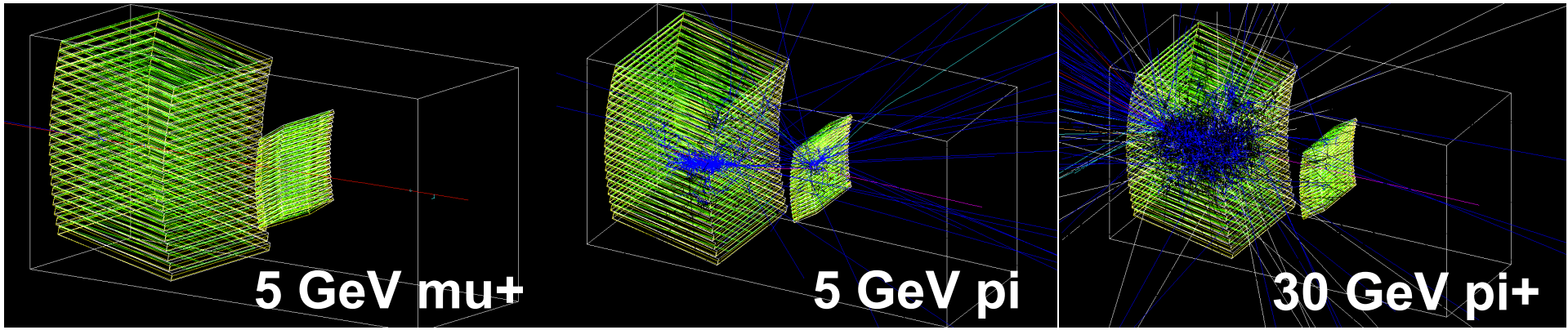
sPHENIX 2ND PROTOTYPE G4 SIMU

Xiaochun He
Georgia State University

General Comments (1)

- Liang has showed his very first version of the 2nd HCAL prototype simulation at the workshop in July at Stony Brook using a software package, called GEMC developed at JLab, since he was very comfortable with the detector geometry manipulation



Source code: https://github.com/EIC-eRD11/sPHENIX-HCalProto

More details about his work can be found from his presentation.

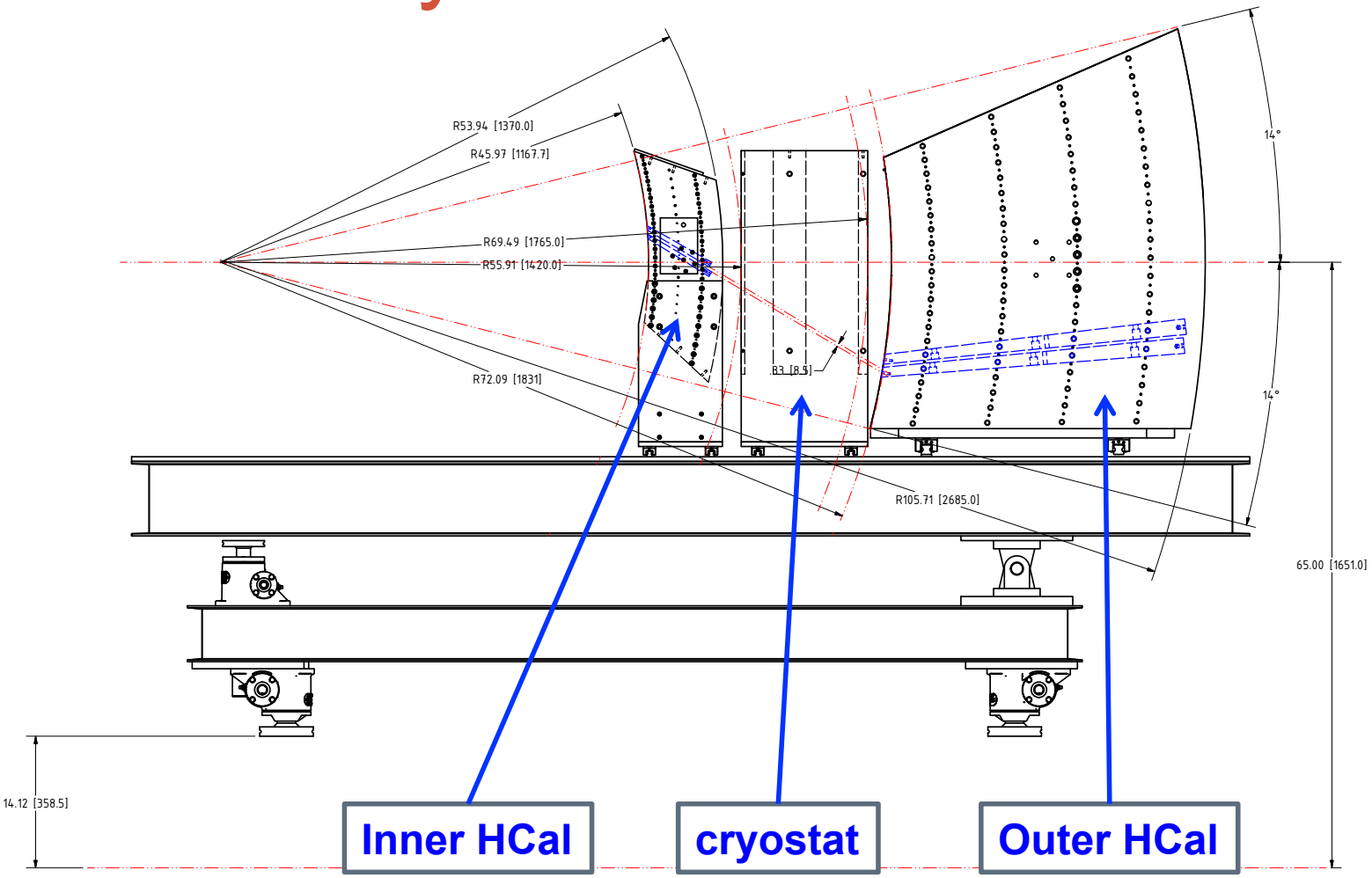
General Comments (2)

- Since Liang left the field, there is very a little progress on this effort. Also, given the very limited manpower, we could not afford to explore other fancy tools for running this simulation especially that it deviates from other major simulation work for sPHENIX.
- Since we had a relatively very successfully simulation study for the first HCal prototype, I followed the same path as we went through for the 1st prototype:
  - Develop the detector geometry in my standalone Geant4 simulation. Most of the work is done on my mac. I could easily manipulate the detector components and display them in any way I want to.
  - Port the detector construction into the sPHENIX G4 simulation framework.
- I will briefly summarize today the current status of this work.

Goals and Milestones

- We need to define the goals and milestones of this simulation in two aspects
  - To aid the running configuration of the 2nd prototype. We could project reference spectra for each orientation of the detector system relative to the beam direction. We could also start running cosmic simulation and compare with cosmic data before we put the detector in the test beam facility
  - To aid the test beam data analysis.

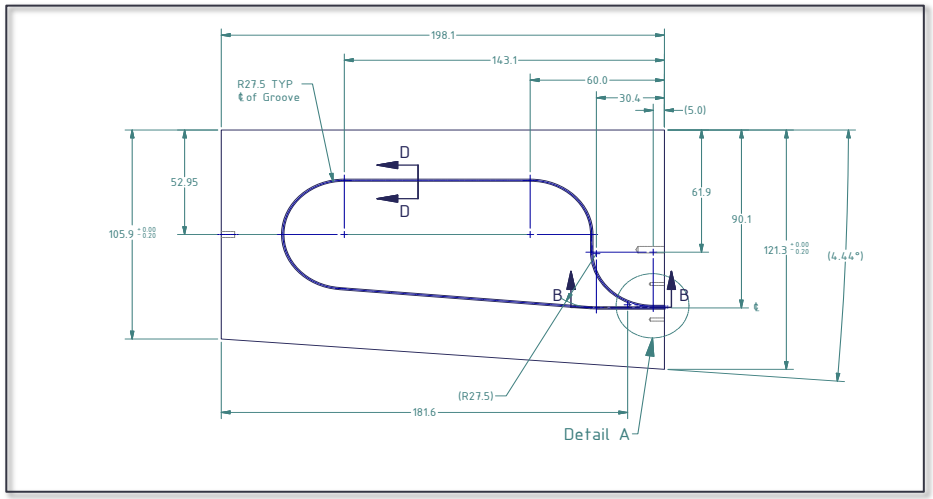
The whole system



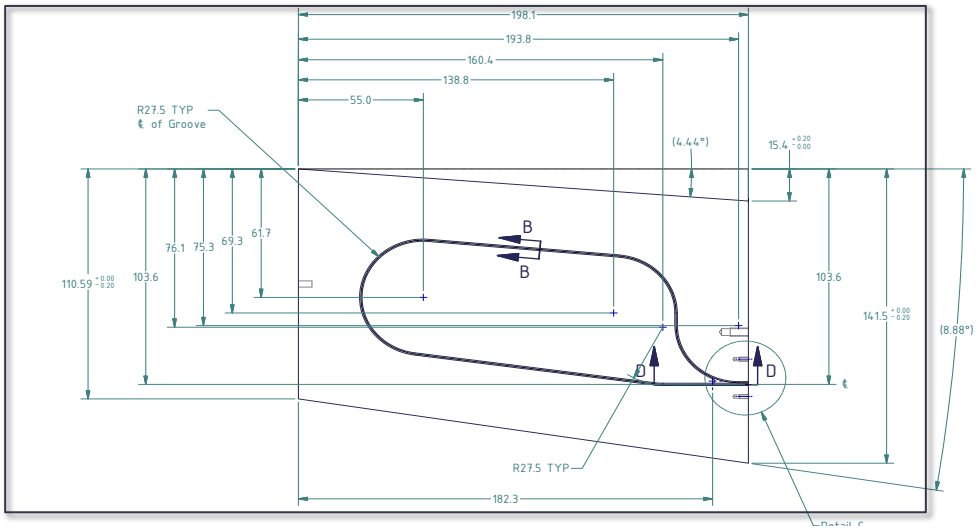
Prototype Dimensions are from R. Ruggiero

Inner Hcal Components

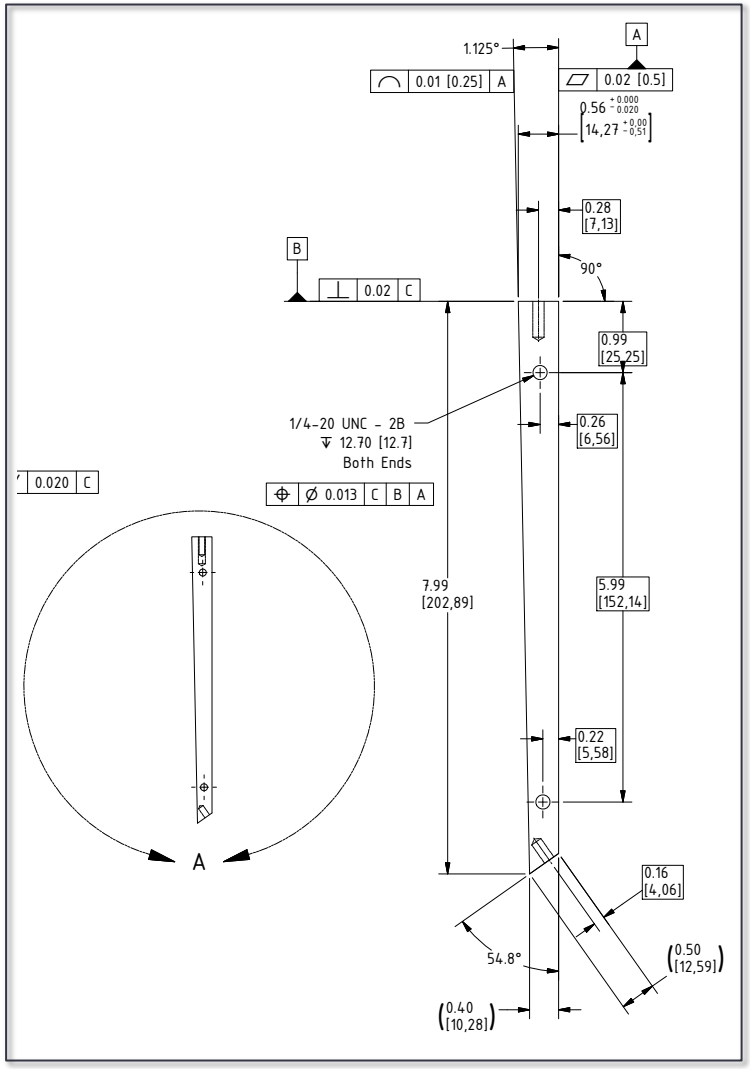
Scint Tile 1



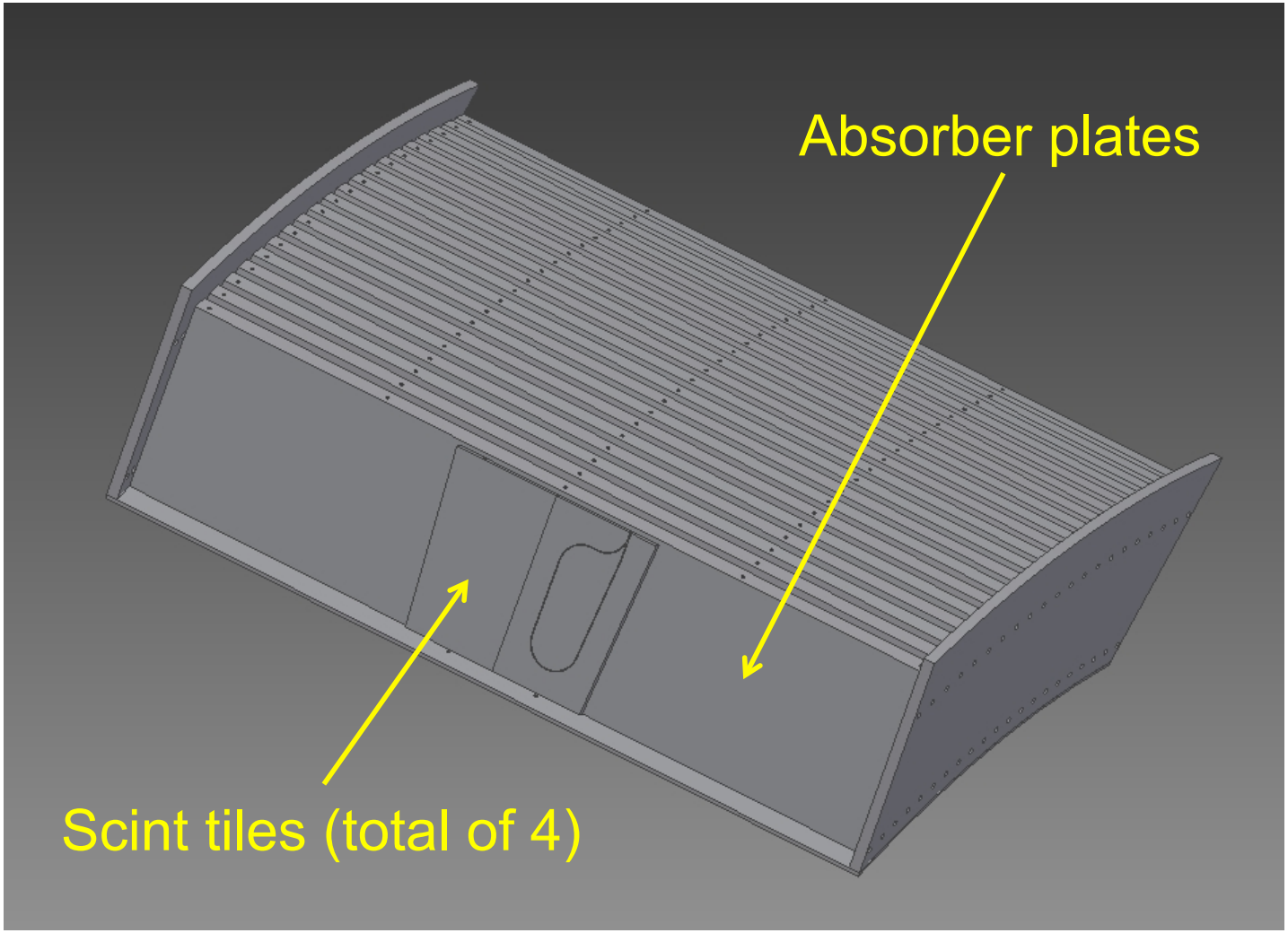
Scint Tile 2



Absorber Plate



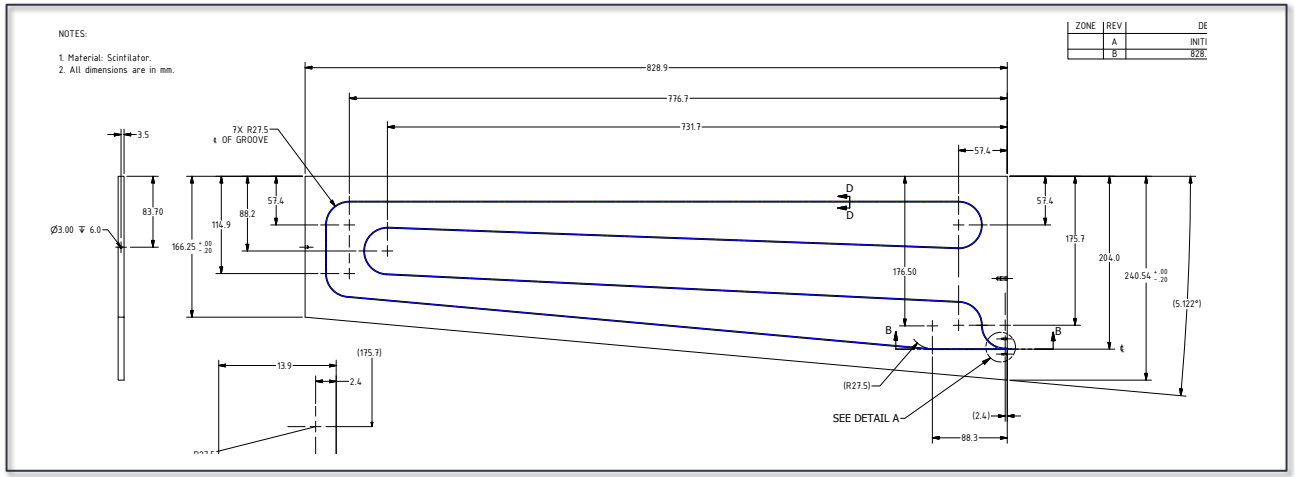
Inner HCal (3D Rendering)



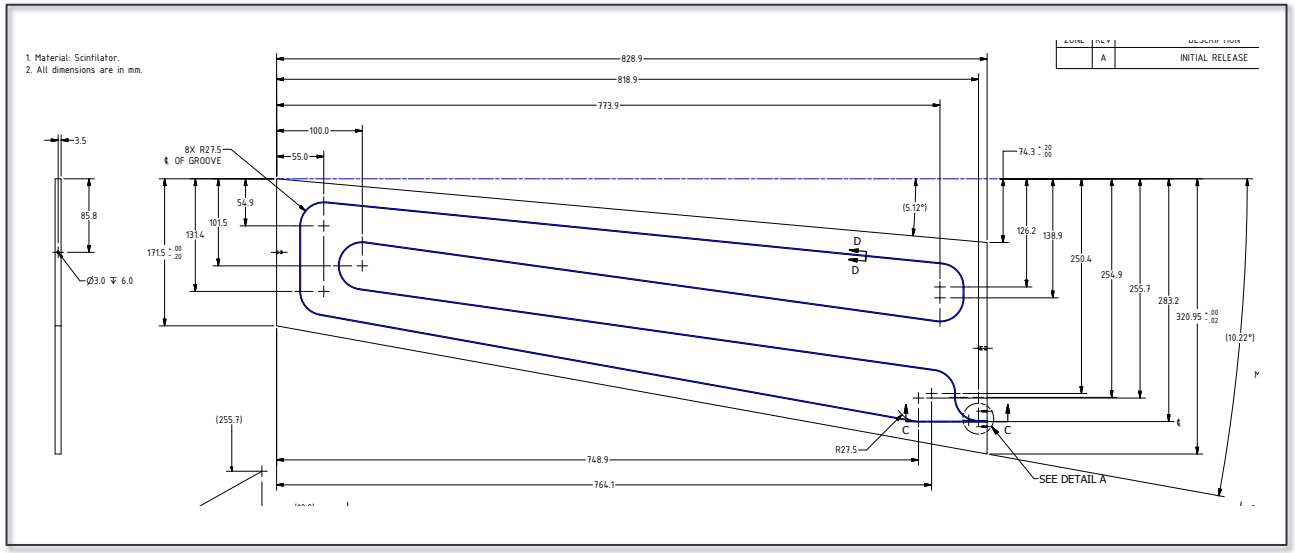
Prototype Dimensions are from R. Ruggiero

Outer Hcal Components

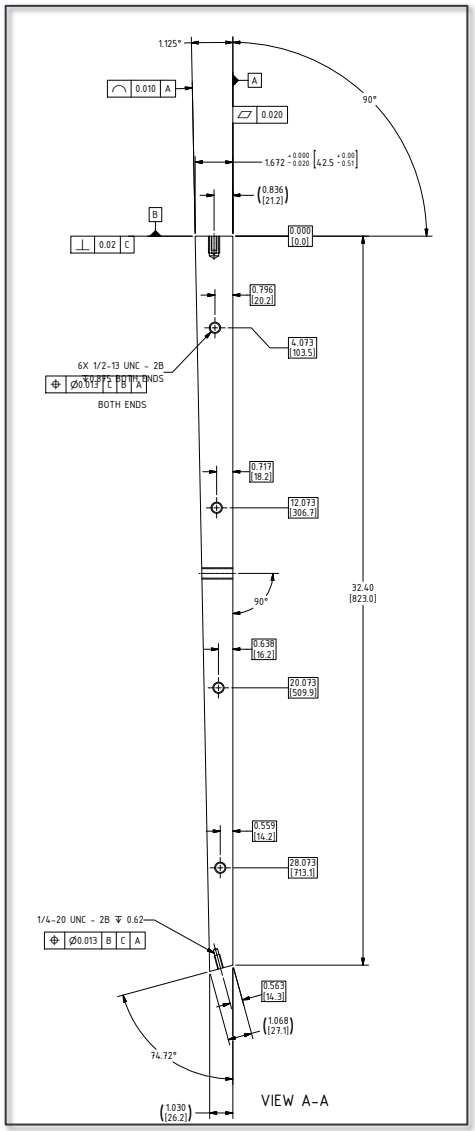
Scint Tile 1



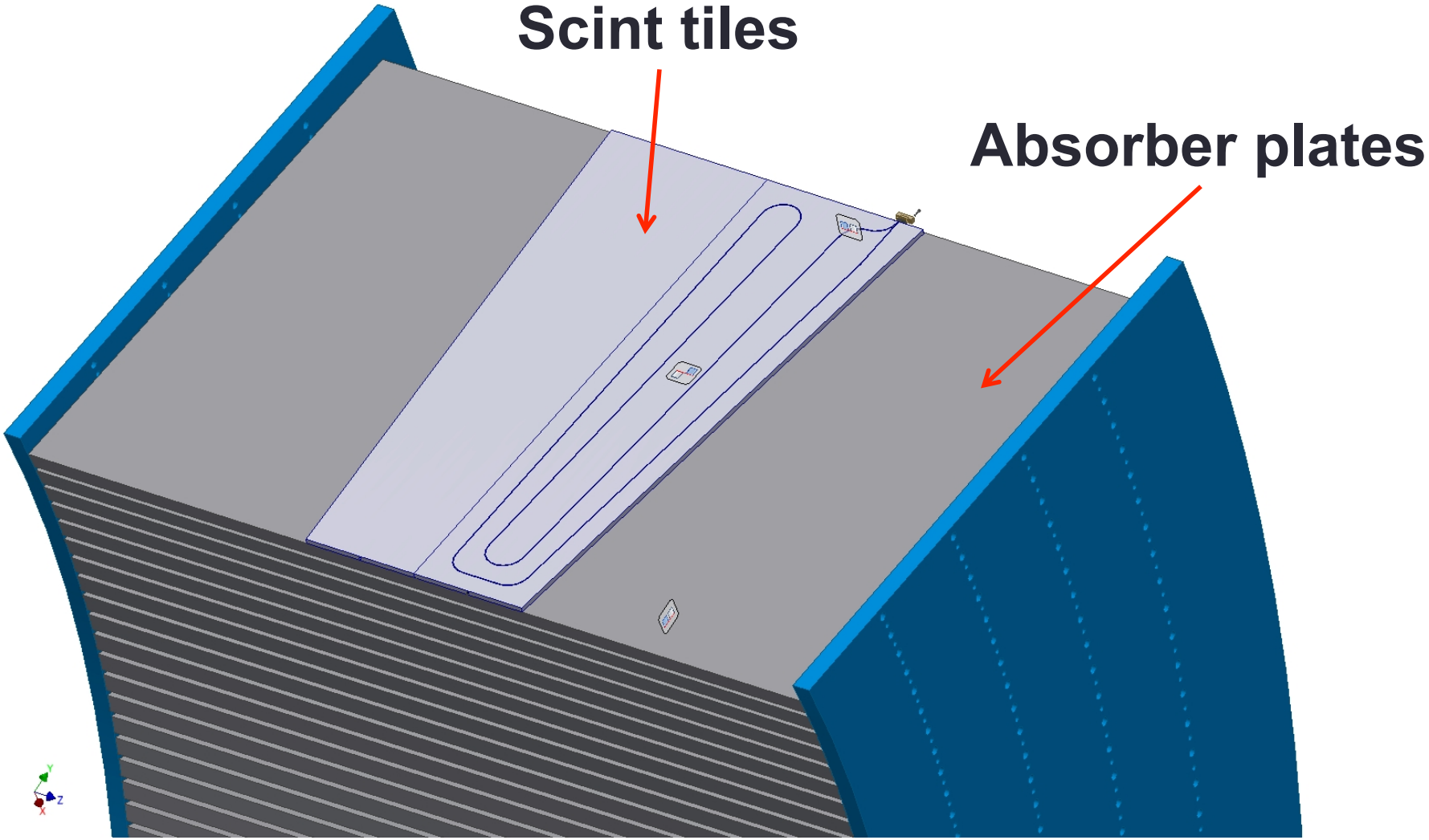
Scint Tile 2



Absorber Plate

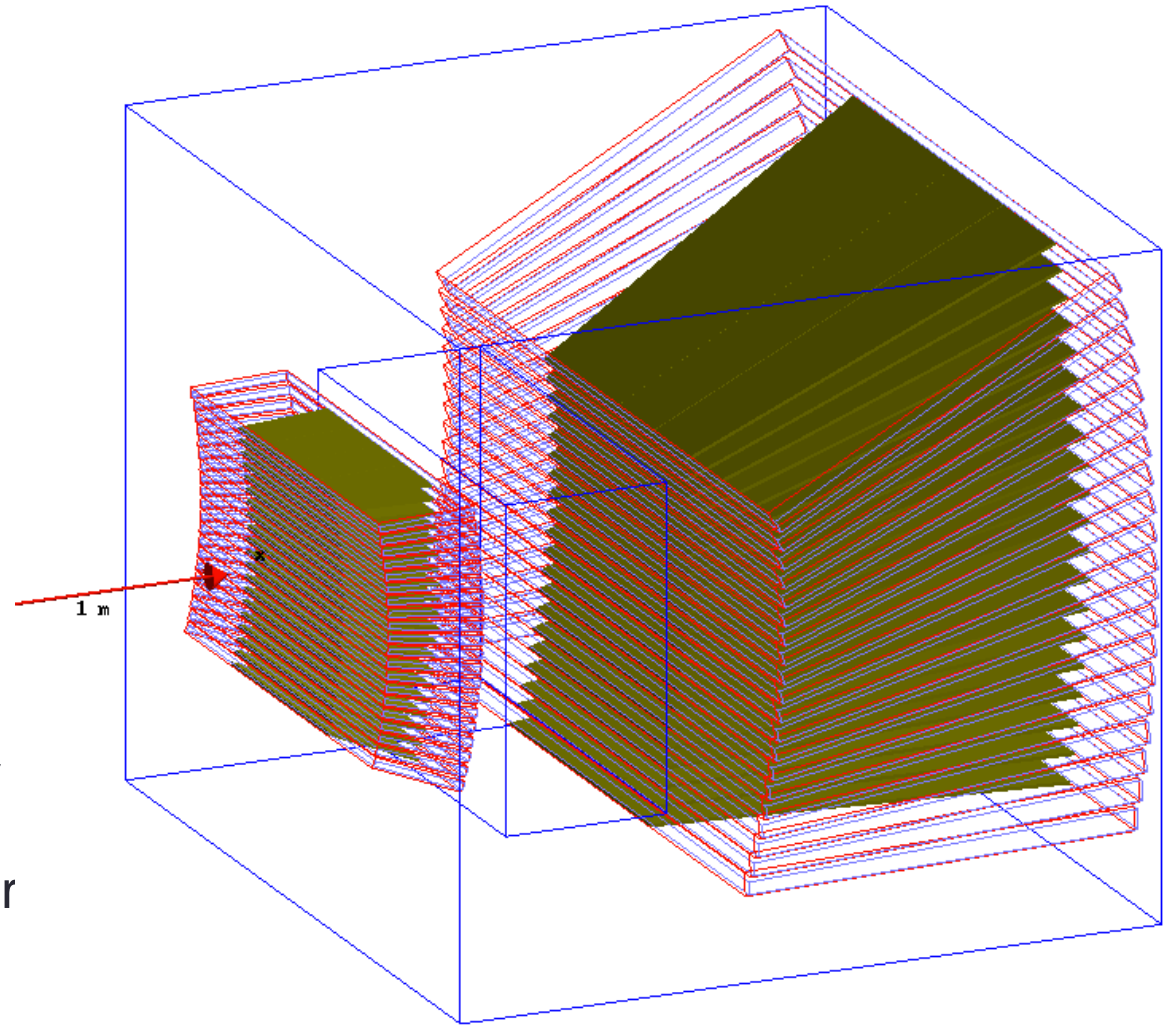


Outer HCal (3D Rendering)

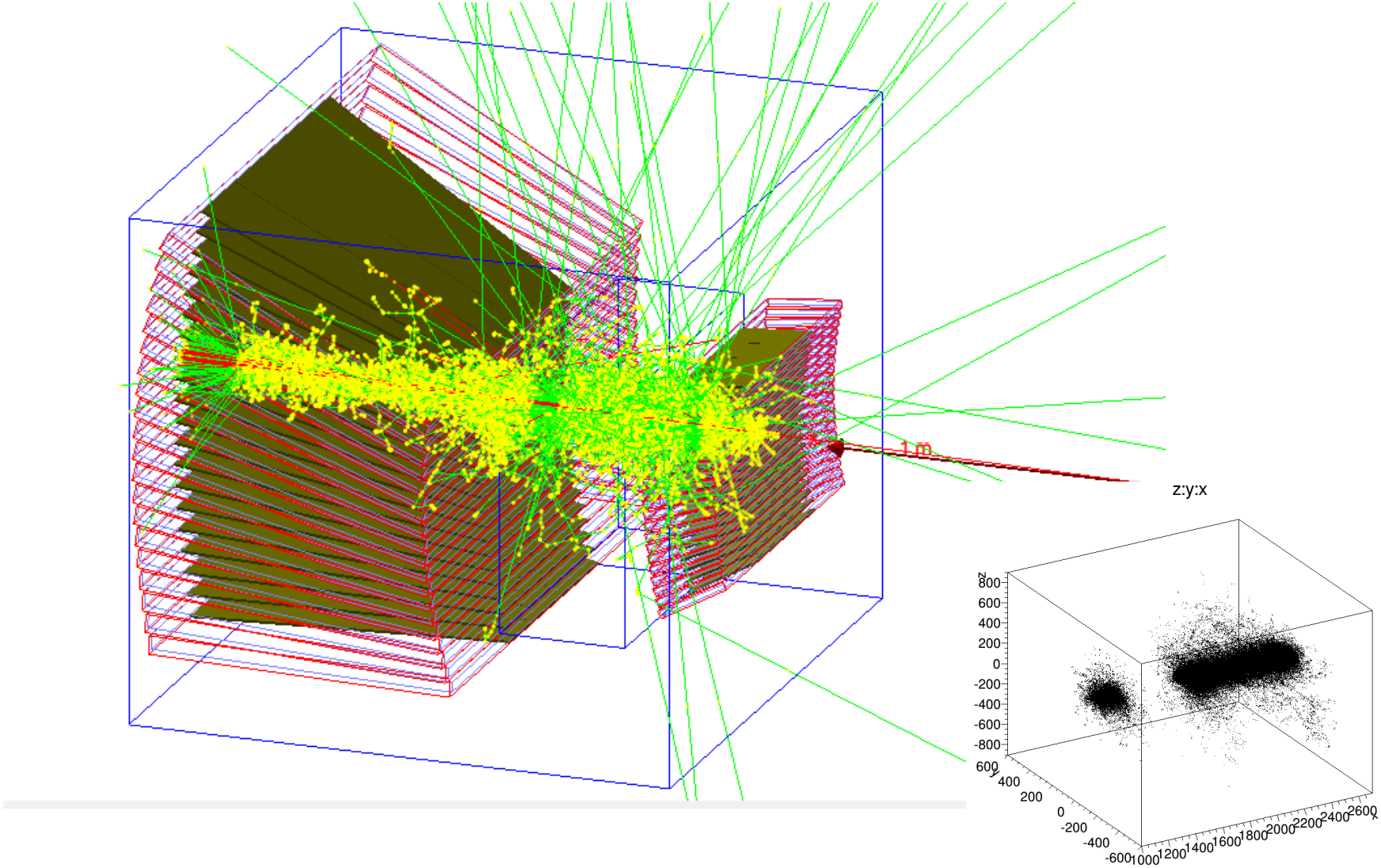


Standalone Geant4 Simulation

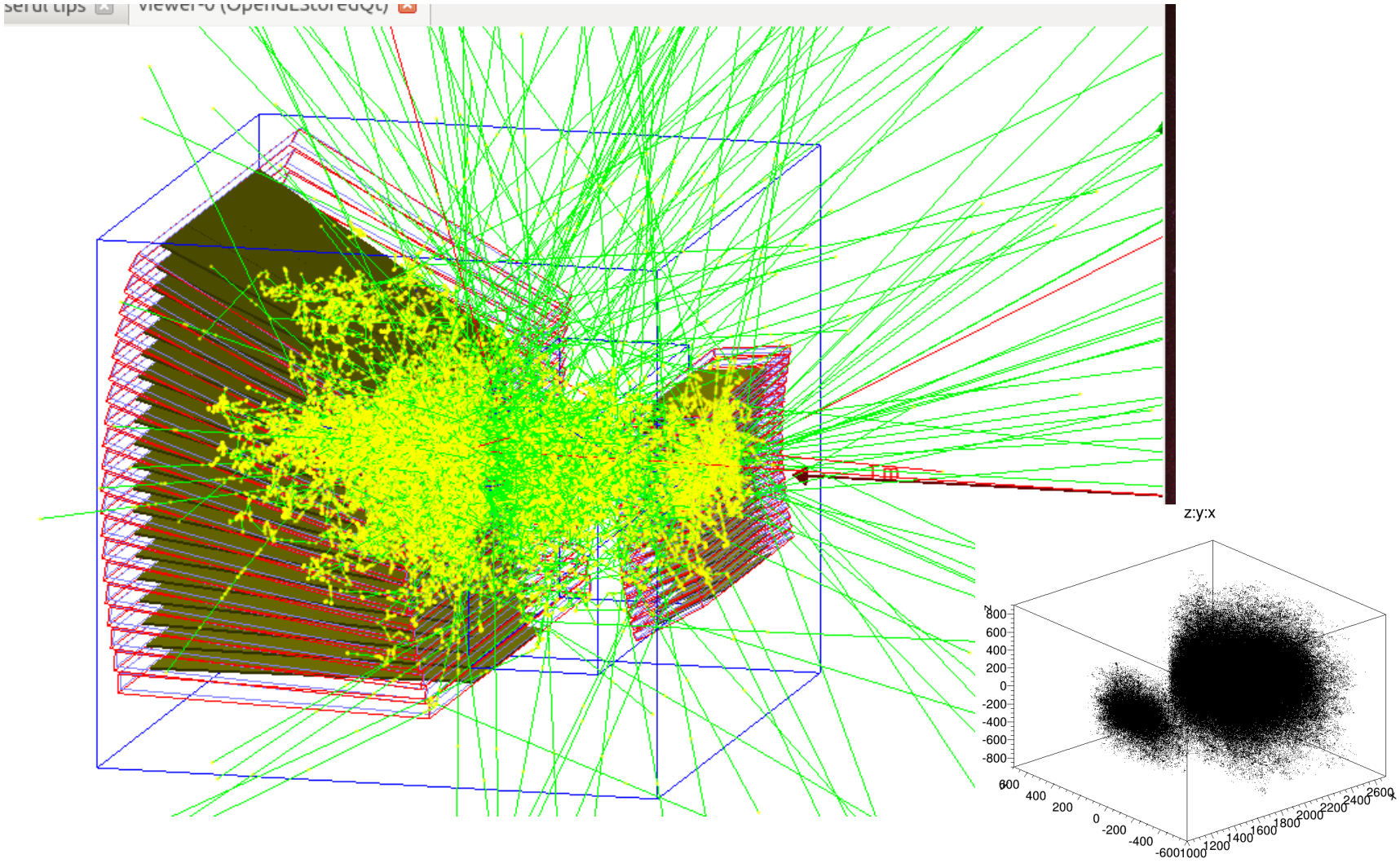
- I started on my Mac (the same for the 1st prototype) and also tested on our local Linux cluster and on RCAS nodes.
- The scint tiles (dark green color) and absorbers (outlined with blue lines) are arranged in a virtual air “pizza” boxes (on magenta color)
- Spacing and tilting have not been fine tuned. I spent quite bit of time for the 1st prototype.
- The big box is the mother volume of all which can be rotated relative to the beam direction.



Event Display (1k mu- events at 10 GeV)



Event Display (100 pi- events at 10 GeV)

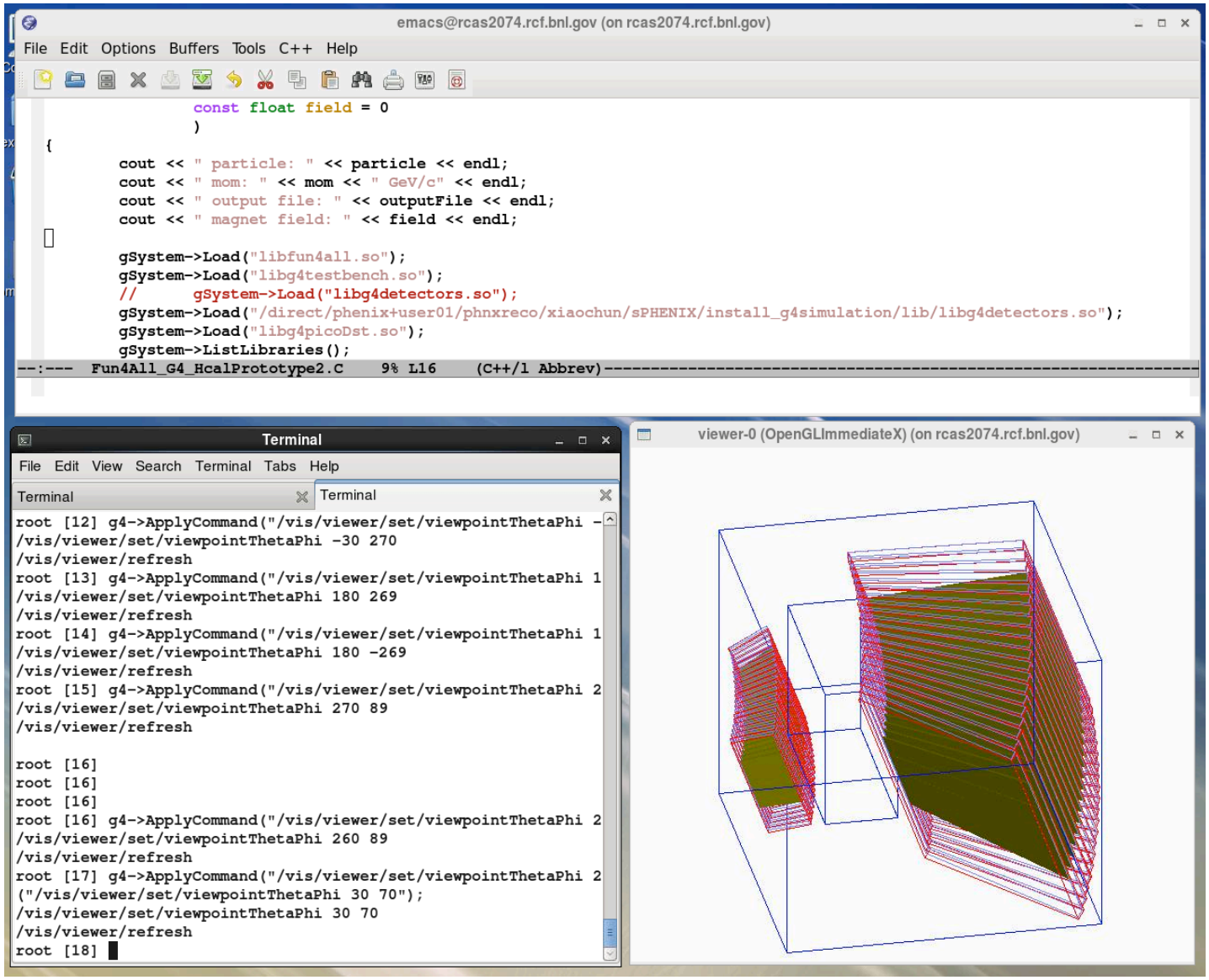


sPHENIX g4simulation implementation

- Over the past weekend, I was able to add the code into the sPHENIX g4simulation framework following the tutorials from Chris and Jin.
- Added codes include are under “coresoftware/simulation/g4simulation/g4detectors”

```
rcas2076: ls -lt *Prototype2*
-rw-r--r-- 1 hexc rhphenix    94 Nov 23 23:22 PHG4HcalPrototype2SubsystemLinkDef.h
-rw-r--r-- 1 hexc rhphenix 29323 Nov 23 22:44 PHG4HcalPrototype2Detector.cc
-rw-r--r-- 1 hexc rhphenix   960 Nov 23 22:23 PHG4HcalPrototype2SteppingAction.h
-rw-r--r-- 1 hexc rhphenix  8680 Nov 23 22:23 PHG4HcalPrototype2SteppingAction.cc
-rw-r--r-- 1 hexc rhphenix  1203 Nov 23 21:54 PHG4HcalPrototype2DetectorMessenger.h
-rw-r--r-- 1 hexc rhphenix  4684 Nov 23 21:53 PHG4HcalPrototype2DetectorMessenger.cc
-rw-r--r-- 1 hexc rhphenix  2467 Nov 23 16:25 PHG4HcalPrototype2Subsystem.h
-rw-r--r-- 1 hexc rhphenix  3967 Nov 23 16:23 PHG4HcalPrototype2Subsystem.cc
-rw-r--r-- 1 hexc rhphenix  3454 Nov 23 16:07 PHG4HcalPrototype2Detector.h
```

Working with g4simulation framework



Fun4All macro for running the simulation

A test session on RCAS Node

To-do

- Continue on refining the geometry and push the code to the land of sPHENIX in github. Have not done this before and will need help from Jin and Chris.
- I will be focusing on detector implementation and Murad is interested in running the analysis. We will give a report at the upcoming workfest in Atlanta.
- Need work on the documentation on sPHENIX wiki.